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Protracted secretory otitis media. The impact of familial factors and day-care center attendance

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Abstract

This study's objective was to assess the impact of familial factors, day-care center attendance, and passive smoking on the incidence of protracted secretory otitis media (SOM). An unselected cohort of 1306 Swedish children were followed from birth to 7 years of age. Information about physician visits and insertions of tympanostomy tubes for SOM was collected at the ENT-departments in one Swedish county. The material was analyzed by life table methods and Cox's regression analysis. At the ages of 3, 5 and 7 years, 1%, 4% and 6%, respectively, of the children had been treated by tympanostomy tubes for SOM. The cumulative incidence of protracted SOM was four times higher among the children who had a sibling with the same health problem. Attendance at a day-care center of 12 or more months during the first 4 years of life increased the risk for protracted SOM by 2.6 times. No association was found between parents' smoking habits and the incidence of protracted SOM.

Introduction

Secretory otitis media (SOM) is a disease in which there is a middle ear effusion, the tympanic membrane is intact and symptoms of acute inflammation are absent. In this study protracted SOM is defined as SOM treated by insertion of a tympanostomy tube.

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A Danish study showed that 20% of 3-year old children had SOM at a screening tympanometric examination and 6% had SOM persisting for 6 months [6]. In another Danish study, also based on tympanometric measurements, SOM lasting for at least 3 months was found in 6% of 210 children (1-6 years of age) who did not utilize municipal day-care [1].

The etiology and pathogenesis of SOM is multifactorial and incompletely understood. Dysfunction of the Eustachian tube is important in the pathogenesis [11,13]. It has been suggested that heredity plays a part in determining a child's likelihood of developing SOM [10]. From tympanometric studies, day-care center attendance is a known risk factor for SOM [5,14,15]. However, previous research has not proven that enrollment in day-care centers comprises a risk factor for protracted SOM. Parental cigarette smoking has also been reported to be a risk factor for SOM by some authors [7,9,12], but not by others [3,16].

The research questions directing this population based cohort study are: (a) How large is the cumulative incidence of protracted SOM among Swedish preschool children? (b) Does the risk for protracted SOM increase if a sibling has or has had the same health problem? and (c) Are the type of day-care and parents' smoking habits risk factors for protracted SOM?

Methods

Study area

The municipality of Östhammar, with a population in 1980 of 21.028, is located in Uppsala county. 70 km (43 miles) northeast of the city of Uppsala and 140 km (87 miles) north of Stockholm. Two thirds of the population lives in five small urban centers and the remainder in rural areas.

Primary health care in Östhammar is available at one larger and three smaller primary health care centers. There was no otorhinolaryngologist (ENT-specialist) working in the study area from 1977 to 1988 and most specialized outpatient care and all inpatient care for children was provided at the two hospitals in Uppsala.

Subjects

The study population comprised all 1306 children born in the municipality of Östhammar between 1977 and 1981. Information about the children's date of birth, gender and address was collected from the County Civic Population Register. Additional demographic data, dates of possible emigration etc., were collected from parish offices in Östhammar. By the children's first, third and seventh birthdays 6%, 15% and 23%, respectively, had moved from the municipality of Östhammar.

Data on use of medical care

Information about all physician visits made by the 1306 children from 1 January 1977 to 31 December 1988 was collected from patient records held at the departments of otorhinolaryngology (ENT), audiology and phoniatrics at two

hospitals in Uppsala. All physician visits due to SOM were retro-actively recorded on a special form with information about the dates of visits and department. All patient records were scrutinized by the author. The principal outcome variable is date of insertion of a tympanostomy tube for SOM. An operation was recorded as tympanostomy for SOM only if middle ear effusion was reported by the ENT specialist. The ENT departments were the only places in Uppsala county where tympanostomy procedures were performed between 1977 and 1988.

Postal questionnaire

In 1990 all parents, including those who had moved from Östhammar, received a questionnaire by mail. Detailed questions were asked about family structure, number and age of siblings, form of day-care and parents' smoking habits during the child's first 7 years of life, the child's use of tympanostomy tubes, and the occurrence among siblings of SOM which led to insertion of tympanostomy tubes. This questionnaire was filled in and returned for 80% of the children.

Statistics

The starting point for all observation periods was the date of birth and the end point the date of a physician visit or an operation for SOM. The follow-up period was 7 years. Children who moved from the municipality or died before their seventh birthday are included in the analyses from the date of birth to the date of migration (or death). Children who moved (or died) before the studied event occurred are type-1 censored cases. Cumulative proportions of children with at least one ENT-physician visit for SOM or insertion of tubes for SOM at least once were estimated by the actuarial life table method [8]. The life tables and survivor functions in BMDP were used. Differences between survivor functions for sub-groups of individuals were compared by using Breslow's generalized test [2]. The effects of a set of covariates on the rate of physician visits for SOM, meaning the hazard rate, were analysed by Cox's proportional hazards regression model [4]. This model is appropriate for censored data if proportionality exists between hazard rates for different values of the covariates. The significance of associations between covariates and the hazard rate was tested by the likelihood ratio test [2,4]. The procedure for survival analysis with covariates in BMDP was used [2].

Reliability study

Recall bias in the parents' answers about their children's use of tympanostomy tubes was studied. The information from the cohort members' patient records about insertion of tympanostomy tubes for any reason during their first 7 years of life was compared to the equivalent data from the questionnaires.

Results

In the reliability study agreement was found for 99% of the children with respect to use or no use of tympanostomy tubes.

TABLE I

Secretory otitis media, insertion of tympanostomy tubes and chronic otitis media during the first 7 years of life

Diagnosis or type of operation	Diagnosis and/or operation during the children's first 7 years of life		
	No. of children (n = 1 306)	Cumulative proportion	Mean age at diagnosis or operation (years)
First visit to an ENT specialist for secretory otitis media	101	0.10	3.9
Second visit to an ENT specialist for secretory otitis media	66	0.07	4.2
Tympanostomy tubes for the first time because of secretory otitis media	56	0.06	4.3
Tympanostomy tubes for the second time because of secretory otitis media	14	0.01	4.5
First visit to an ENT specialist for chronic otitis media	2	0.002	3.2

Ten percent of the children had visited an ENT-specialist at least once for SOM. Fifty-six (6%) were treated for SOM with a tympanostomy tube through one or both tympanic membranes at a mean age of 4.3 years (Table I).

TABLE II

Cumulative proportions of children treated with tympanostomy tubes at least once because of secretory otitis media during the first 7 years of life, by gender

Gender	Follow-up period in years of life							Proportion censored at the seventh birthday
	1.0	2.0	3.0	4.0	5.0	6.0	7.0	
Boys (n = 633)	0.00	0.00	0.01	0.01	0.03	0.03	0.04	0.24
Girls (n = 673)	0.00	0.00	0.01	0.02	0.04	0.06	0.07	0.22
Total (n = 1 306)	0.00	0.00	0.01	0.02	0.04	0.05	0.06	0.23

TABLE III

Cumulative proportions of children treated with tympanostomy tubes because of secretory otitis media during the first 7 years of life, according to the presence of this disease among siblings

A sibling has or has had tympa-nostomy tubes	Follow-up time in years of life							Proportion censored at the seventh birthday
	1.0	2.0	2.5	3.0	4.0	5.0	7.0	
Yes ($n = 70$)	0.00	0.02	0.03	0.10	0.12	0.14	0.18	0.21
No ($n = 910$)	0.00	0.00	0.00	0.01	0.01	0.03	0.05	0.17

Table II shows that 4% of the boys and 7% of the girls had tympanostomy tubes inserted for SOM during the first 7 years. The difference was not statistically significant ($P = 0.10$).

Table III shows that SOM treated by tympanostomy tubes was at least three times as common among those children who had a sibling who had also received treatment for SOM by tympanostomy tubes ($P = 0.0000$). Only children who had at least one sibling are included.

Table IV shows proportions of children who got a tympanostomy tube through one or both tympanic membranes at least once during preschool age by type of day-care. Included are only those enrolled in either municipal day-care centers (DCCs) or in municipal family day-care homes (DCHs) for at least 12 months of

TABLE IV

Cumulative proportions of 710 children treated with tympanostomy tubes because of secretory otitis media during the first 7 years of life, by form of day-care

Form of day-care	Follow-up time in years of life							Proportion censored at the seventh birthday
	1.0	2.0	3.0	4.0	5.0	6.0	7.0	
Municipal day-care center ($n = 213$)	0.00	0.01	0.03	0.05	0.07	0.09	0.10	0.17
Municipal family day-care home ($n = 67$)	0.00	0.00	0.02	0.04	0.04	0.06	0.10	0.28
Day-care only in the child's own home ($n = 435$)	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.13

TABLE V

Cumulative proportions of 1022 children treated with tympanostomy tubes because of secretory otitis media during the first 7 years of life, by mothers' smoking habits

The mothers' smoking habits	Follow-up time in years of life							Proportion censored at the seventh birthday
	1.0	2.0	3.0	4.0	5.0	6.0	7.0	
Non-smokers (n = 585)	0.00	0.00	0.01	0.02	0.04	0.05	0.06	0.17
10 cigarettes or more per day during the child's first 4 yrs of life (n = 247)	0.00	0.00	0.01	0.01	0.03	0.03	0.04	0.18
Mothers not belonging to any of the groups above (n = 190)	0.00	0.00	0.02	0.02	0.04	0.05	0.07	0.17

the first 4 years of life, and those cared for in their own homes during all of the first 4 years. Excluded are children who attended a DCC as well as a DCH during the first 4 years of life. The difference between the children attending a DCC and those cared for at home proved to be highly significant ($P = 0.0006$). The difference between children in DCH and those cared for in their own homes was on the other hand not significant ($P = 0.08$).

The children were divided into three groups according to their mothers' smoking habits: Mothers who smoked 10 or more cigarettes per day throughout their child's first 4 years of life, mothers who were non-smokers during the child's first 4 years, and the remaining group. No significant differences were found between any of these groups of children ($P = 0.23$) (Table V).

Analyses which included only the two-parent families were also performed. No difference was present in proportions treated with tympanostomy tubes between the children whose mothers and fathers were non-smokers, those whose mothers and fathers had smoked 10 or more cigarettes per day and children from the remaining two-parent families.

Table VI shows a multivariate analysis with three independent variables showing statistically significant associations with the dependent variable (occurrence of protracted SOM). Because of its importance for the totality one insignificant independent variable (enrollment in DCH) is also included in Table VI. This analysis included only children with siblings. The relative risk (RR) that a child would get tympanostomy tubes because of SOM increased 4 times if he or she had a sibling who had received treatment by tympanostomy tubes for the same reason.

TABLE VI

Cox's regression model for associations between independent variables and hazard rate for SOM treated with tympanostomy tubes (n = 975)

Independent variable	No. of children	Beta-estimate	Relative risk (RR)	95% confidence interval for relative risk
A sibling has or has had tympano-stomy tubes				
Yes	70	1.42	4.15	(2.06; 8.38)
No *	905			
The child is oldest among the siblings				
Yes	433	0.58	1.79	(1.01; 3.18)
No *	542			
Municipal day-care center during 12 mos of the first 4 yrs of life				
Yes	197	0.95	2.59	(1.42; 4.74)
No *	778			
Municipal family day-care home during 12 mos of the first 4 yrs of life				
Yes	66	0.66	1.94	(0.68; 5.57)
No *	909			

* Reference category

The RR for protracted SOM was 1.8 times higher among those who were the oldest child in the family compared to the children who had older siblings. The RR for SOM treated by tubes increased 2.5 times for those children enrolled in a DCC for at least 12 months during the first four years of life, as compared to those who had been cared for in their own homes during their first 4 years. The RR for enrollment in DCH (1.94) was not statistically significant.

An analysis including the same variables as found in Table VI but only those cohort members whose siblings were born either before 1977 or after 1981 showed virtually the same results. In other analyses not shown no associations were found between the number of siblings and occurrence of SOM treated with tympanostomy tubes.

Discussion

It is an advantage that the children were as old as 9–13 years in 1990 when data about protracted SOM in siblings were collected. Very few of the cohort members

got new siblings after 1990, who might become new cases suffering from protracted SOM. Accordingly, it is highly likely that the information about protracted SOM in siblings is complete or almost complete.

As stated in Rockley and Rhys Evans [10], it is nearly impossible to determine whether or not an individual has suffered from SOM on the basis of otological history. However, the reliability of the information from questionnaires about a child's use of tympanostomy tubes was very high. Parents were thus fully capable of recalling their children's use of tympanostomy tubes during the previous 5-10 years.

The risk for protracted SOM increased four times if a sibling had had the same disease. When interpreting this finding it is important to keep in mind that the form of day-care and parents' smoking habits were taken into account in the multivariate analysis. Parents may still be more inclined to seek an ENT-specialist and perhaps suggest tympanostomy tubes for their child if previous experiences of that treatment of an older sibling had been positive. This type of confounding was eliminated by including place in sibship in the regression analysis. Since the form of day-care was controlled for, concordance between siblings cannot be explained by any tendency among siblings to attend the same type of day-care.

The RR for protracted SOM was 1.79 among those who were the oldest child in the family compared to the children who had older siblings. However, the lower limit of the 95% confidence interval for the RR was very near 1.00. Consequently this association might be due to random error.

In their case-control study, Rockley and Rhys Evans [10] examined otologically 146 parents of 73 children aged 1-4 years admitted to British ENT-departments for surgical treatment of SOM, and 70 parents of 35 children admitted to the same hospitals for surgery other than SOM. They described tympanic membrane abnormalities suggesting SOM previously in life among 39% of the parents of the cases with SOM and among 14% of parents of the controls. Based on this data the odds ratio of 3.84 is easily calculated. Regardless of differences in specific study design, there is close agreement between the odds ratio from Rockley's and Rhys Evans' study and the RR of 4.15 in the present study.

In accordance with Rockley and Rhys Evans [10], the present study clearly shows that familial factors are important in the etiology of protracted SOM. The intra-familial associations can not be explained by similarities among siblings with respect to form of day-care or passive smoking in the home. The pathophysiological mechanisms behind these intra-familial associations remain to be identified by future research.

Younger siblings of children with protracted SOM comprise a risk group for the same disease. While previous tympanometric studies have shown that enrollment in a DCC comprises a risk factor for single short episodes of SOM, the present study has confirmed attendance in DCCs as a risk factor for protracted SOM. Attendance in DCC is thus not suitable for children with protracted SOM. This form of day-care is even less appropriate if an older sibling to the child with protracted SOM has or has had the same disorder.

Acknowledgements

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